GUARD MECHANISM ATTACHABLE TO STANDARD SYRINGES TO MAKE THEM INTO DISPOSABLE AUTOMATIC SAFETY SYRINGES AND RELATIVE DISPOSABLE AUTOMATIC SAFETY SYRINGE

DESCRIPTION

The present invention refers to a guard mechanism attachable to a conventional syringe to make it into a disposable automatic safety syringe. The present invention also refers to a disposable automatic safety syringe obtained with said guard mechanism.

As is known, a syringe generally comprises a cylindrical body open at the rear to receive a plunger. A needle hollow on the inside is mounted at the head of the syringe body. On retraction of the plunger the liquid contained in a vial is drawn into the syringe body through the needle. On pressing on the plunger the liquid contained in the syringe body is injected, through the needle, into the patient's body.

Because of health regulations and to avoid transmission of infectious diseases, syringes must generally be used only once and then discarded. For this reason, there is a growing market demand for disposable syringes able to prevent further use.

Moreover, syringes generally present drawbacks from the point of view of safety. In fact, once the syringe has been used, the needle remains exposed at the head of the syringe body, with the risk of injuries and accidental needle sticks.

Patent application PCT WO 99/37345 describes a disposable safety syringe which has a needle covering sleeve mounted axially on the body of the syringe and slidable from a

retracted position, wherein it leaves the needle exposed to allow injection, to a forward position wherein it completely covers the needle, preventing re-use of the syringe and acting as a guard against accidental needle sticks.

Once the injection has been performed, the sleeve is automatically brought into the extracted safety position, by means of an automatic mechanism and without any intervention by the user. However, this solution presents a certain complexity due to the presence of various additional elements for operation of the automatic mechanism.

The object of the present invention is to eliminate the drawbacks of the prior art, providing a guard mechanism that is extremely versatile and suitable to be applied to a conventional syringe to make it into a disposable automatic safety syringe.

Another object of the present invention is to provide such a guard mechanism that is economical, simple to make and simple to assemble.

Another object of the invention is to provide such a mechanism that allows a controlled intervention of the guard on the syringe on completion of the injection.

Yet another object of the present invention is to provide such a disposable automatic safety syringe that is able to prevent both further attempts at use of the needle and accidental injury after use thereof.

These objects are achieved in accordance with the invention with the guard mechanism according to appended independent

claim 1 and with the disposable automatic safety syringe according to appended independent claim 12.

Advantageous embodiments of the invention are apparent from the dependent claims.

According to the invention a guard mechanism is applied to a standard syringe to make it into a disposable automatic safety syringe.

The syringe comprises a syringe body hollow on the inside and open at the front and the rear, a plunger that can slide inside the syringe body with an injection stroke extending from a retracted syringe-filling position to a forward syringe-emptying position, and an injection needle supported by a needle-carrying support engageable to the fore end of the syringe body. The plunger is provided at the rear with a shaft that can be operated manually and brought out of the syringe body through the rear end thereof.

The guard mechanism comprises a sleeve, spring means and an abutment member for the spring.

The abutment member for the spring is suitable to be mounted at the head of the syringe body and can act as a support for a injection needle.

The sleeve is mounted so that it can slide over the spring abutment member and the syringe body, to pass from a retracted position of use of the syringe to a forward position of safety, wherein it covers the needle.

The spring means are disposed under compression in the front part of the sleeve between the sleeve and the abutment member to urge the axial movement of the sleeve in

the forward position of safety with respect to the syringe body.

The sleeve is locked in the position of use of the syringe by means of locking means, in reciprocal engagement, provided in the rear part of the sleeve and of the syringe body.

In the rear part of the shaft, on the other hand, operating means are provided to release the locking means when the plunger reaches the end of the injection stroke, so as to allow the action of the spring means which automatically generate the axial movement of the sleeve with respect to the syringe body. Such operating means can be made integral with the shaft, or they can form part of the guard mechanism and thus can be applied to the shaft.

The advantages of the guard mechanism according to the invention are evident.

In fact such a guard mechanism, comprising only three additional elements, that is to say the sleeve, the spring means, and the spring abutment means, proves extremely cheap and simple to make, and can be applied in a simple and convenient manner to a conventional syringe either automatically or manually to make it into a disposable automatic safety syringe.

The disposable automatic safety syringe obtained with a guard mechanism according to the invention is practical for the user and meets the objects of the present invention.

In fact, once the injection has been completed, the sleeve automatically and without any intervention by the user moves telescopically on the syringe body, so as to cover the needle. In this manner the needle comes to be in a

position of safety, thus avoiding accidental needle sticks and possible attempts to reuse the needle, which remains trapped in the sleeve.

Further characteristics of the invention will be made clearer by the detailed description that follows, referring to a purely exemplary and therefore non limiting embodiment thereof, illustrated in the appended drawings, wherein:

Figure 1 is an exploded axonometric view, illustrating the guard mechanism according to the invention and a conventional syringe;

Figure 2 is an axial sectional view of a sleeve forming part of the guard mechanism of Figure 1;

Figure 3 is an axial sectional view of a spring abutment member forming part of the guard mechanism of Figure 1;

Figure 4 is a view, partially in axial section, of the syringe of Figure 1 assembled with the guard mechanism, wherein the shaft of the plunger has not been sectioned and has a safety tab and the needle is shown partially broken off;

Figure 5 is an axial sectional view, like Figure 4, of the syringe assembled with the guard mechanism, wherein the safety tab of the plunger shaft has been removed and the plunger is at its forward end-of-stroke point;

Figure 6 is an axial sectional view, like Figure 4, of the syringe assembled with the guard mechanism, wherein the needle is in the safety position protected by the sleeve and wherein the syringe body and plunger shaft assembly is shown partially broken off;

Figure 7 is an axonometric view of the syringe assembled with the guard mechanism, during use; and

Figure 8 is an axonometric view of the syringe assembled with the guard mechanism in the safety position.

The guard mechanism according to the invention, attachable to a syringe to make it into a disposable automatic safety syringe, is described with the aid of the figures.

With reference for now in particular to Figure 1, there is illustrated a conventional syringe, denoted as a whole with reference numeral 100, and guard mechanism consisting of a set of components, denoted as a whole by reference numeral 200.

The syringe 100 is a syringe commonly available on the market and comprises a syringe body 1, an injection needle 2, a plunger 4 and a shaft 41.

The syringe body 1 is cylindrical, hollow on the inside, and defines a cylindrical chamber 10. The rear end of the body 1 is outwardly open and has an annular collar 11 that protrudes radially outward. Two tongues or flanges (not shown) that protrude radially outward, in diametrically opposite positions, can be provided on the annular rim 11 to define gripping means for the user's fingers.

The front end of the body 1 ends in a head 115, outwardly open, having the shape of a substantially cylindrical or frusto-conical tang, with a much smaller diameter than the body 1, so as to define a shoulder 15 on the front part of the syringe body 1.

The injection needle 2 is mounted on or built-in in a cylindrical or frusto-conical needle-carrier 20, hollow on

the inside, having an axial chamber 23 able to receive the tang 115 of the head of the syringe body. The needle-carrier 20 can have, at its free end, a collar 21 with two tongues 22 protruding radially in diametrically opposite positions. The tongues 22 can be replaced by an outer thread. A needle cap 24 engages with the needle-carrier 20 to cover the needle 2.

The plunger 4 can slide sealingly inside the chamber 10 of the syringe body 1. The plunger 4 is mounted on the head 40 of the shaft 41. The shaft 41 is cross-shaped in cross section and ends at the rear in a disc-shaped flange 42 which provides an abutment surface for the user's fingers during the injection.

Near the rear flange 42, around the shaft 41, an operating crown or disc 43 can be provided. A safety tongue 45 that protrudes radially and longitudinally outward from the shaft 41 is disposed between the rear flange 42 and the operating crown 43. The safety tab 45 is connected to the shaft 41 by means of a breakable connecting strip 46, such as a strip of perforated material acting as a line of weakening. In this manner the user can remove the safety tongue 45 manually by tearing the line of weakening 46.

The operating crown 43 can be made in a single body with the shaft 41 or with the rear flange 42 of the shaft 41. In the case of the shaft 41 of the conventional syringe 100 not having the operating crown 43, said operating crown 43 can be made as a separate element forming part of the set of components 200 and thus able to be assembled to the shaft 41, as shown in the figures.

The set of components 200 comprises a sleeve 5, a spring 7, an abutment member 8 for the spring and optionally an operating crown 43.

As shown also in Figure 3, the abutment member 8 has a cylindrical or frusto-conical body 80 hollow on the inside, having an axial cavity 81 with a diameter substantially equal to the outside diameter of the front part of the syringe body 1 to be able to attached thereto by pressure. The abutment member 8 has at the front and axially a cylindrical or frusto-conical tang 82, with a smaller diameter than that of the body 80, so as to give rise to a shoulder 84. The tang 82 is hollow on the inside and has an inside thread 83.

In this manner, when the abutment member 8 is applied to the head of the syringe body, the tang 115 of the syringe body is disposed axially inside the tang 82 of the abutment member, leaving an annular space between the outer surface of the tang 115 of the syringe body and the inner surface of the tang 82 of the needle-carrier member, so as to give rise to a so-called Luer cone on the head of the syringe body to receive the needle-carrier 20 of the injection needle 2. In this case, the abutment member 8 acts as a supporting member for the needle 2.

As shown also in Figure 2, according to the invention, the set of components 200 comprises a safety device for the syringe, denoted by reference numeral 5 and taking the form of a substantially cylindrical sleeve, hollow on the inside, having an axial chamber open at the front and rear. The sleeve 5 has a front part 51 with a smaller diameter ending in an annular collar 52 that protrudes radially inward. The inside diameter of the body 50 of the sleeve body is slightly greater than the outside diameter of the body 80 of the abutment member 8, so that the sleeve 5 can slide axially on the body 80 of the abutment member 8, when the abutment member 8 is applied to the head of the syringe body 1.

Near the rear part of the body 50 of the sleeve there are provided two rigid tongues or flanges 53 which protrude radially outward, in diametrically opposite directions, to give rise to a resting surface for the user's fingers.

Two pairs of longitudinal flexible tongues 56, 66 are provided in the rear part of the body 50 of the sleeve, forward and rearward with respect to the flanges 53, respectively.

The first pair of tongues 56 is disposed forward of the flanges 53 and has two tongues 56 disposed in diametrically opposite positions. Each front tongue 56 is slightly inclined towards the inside and ends in a rear abutment surface 58. Each front tongue 56 is defined by a substantially U-shaped cut 57 made on the body of the sleeve, so as to be able to bend with respect to the sleeve body.

The second pair of tongues 66 is disposed to the rear of the flanges 53 and has two tongues 66 disposed in diametrically opposite positions. Each rear tongue 66 is inclined slightly inward and ends in a front abutment surface 68, substantially opposed to the rear abutment surface 58 of the respective front tongue 56. Each rear tongue 66 is defined by a substantially U-shaped cut 67 made in the body of the sleeve, so as to be able to bend with respect to the body of the sleeve.

Lastly, the set of components 200 comprises the spiral spring 7, designed to be housed in the front part 52 of the sleeve body. In fact the outside diameter of the spring 7 is slightly smaller than the inside diameter of the front part 51 of the sleeve body 5.

Assembly of the set of components 200 on the syringe 100 will be described hereunder, purely by way of example, with the aid also of Figure 4.

The guard mechanism 200 can be supplied pre-assembled. That is to say, the spring 7 is inserted in the sleeve 5, from the rear of the sleeve 5, so that the end of the spring abuts against the collar 52 of the front part of the sleeve 5. The abutment member 8 for the spring is then inserted into the sleeve, again from the rear of the sleeve, so that the shoulder 84 of the abutment member abuts against the other end of the spring. Then, by lightly forcing the abutment member 8 into the sleeve, the body 80 of the abutment member passes the pair of rear tongues 66 and thus the rear edge of the abutment member is blocked by the front abutment surface 68 of the rear tongues of the sleeve, preventing the abutment member from coming out of the sleeve.

At this point the pre-assembled protection mechanism 200 can be attached to a conventional syringe 100, mechanically or manually. In fact, it is sufficient to force the syringe body 1 into the sleeve 5, from the rear of the sleeve. In this manner the tang 115 of the syringe body is inserted into the abutment member 8 until the shoulder 15 of the syringe body 1 abuts against the shoulder 84 of the abutment member. In this situation the abutment member 8 is integral with the front part of the syringe body 1 and a Luer cone consisting of the inside tang 115 of the syringe body and the outside tang 82 of the abutment member is formed in the head of the syringe body. By advancing the syringe body and causing the tongues 56 to bend slightly outwards, possibly with the aid of suitable means, the syringe body pushes the abutment member 8 slightly forward, compressing the spring in the front part 51 of the sleeve.

As shown in Figure 4, when the rear edge 11 of the syringe body passes the pair of rear tongues 66 of the sleeve, the front abutment surface 68 of the rear tongues 66 abuts against the rear edge 11 of the syringe body, preventing the syringe body from coming out of the sleeve 5 through the action of the spring 7. At this point the syringe 100 with the guard mechanism 200 is ready for use.

It should be noted that in this situation the safety tab 45 fixed to the shaft 41 abuts against the rear edge of the sleeve 5, preventing the shaft 41 from advancing further, so that the operating crown 43 does not cooperate with the rear tongues 66 of the sleeve, triggering the guard mechanism 200.

Operation of the syringe 100 provided with the guard mechanism 200 according to the invention is described hereunder with reference to Figures 5 to 8.

Before carrying out the injection, the user manually tears the safety tab 45 along the perforated line of weakening 46.

As shown in Figure 5, when the plunger 4 reaches the end of its injection stroke inside the chamber of the syringe body, the operating crown 43 of the shaft 41 comes into contact with the flexible rear tongues 66 of the sleeve, causing outward bending of said tongues 66.

As a result, the rear edge 11 of the syringe body disengages from the protrusions 68 of the rear tongues 66. Consequently, axial movement of the sleeve 5 with respect to the syringe body 1 is no longer prevented. Thus through the action of the spring 7 which is released, the sleeve 5 can move axially forward with respect to the syringe body 1 and/or the syringe body 1 can move axially rearward with

respect to the sleeve 5. It should be noted movement of the sleeve 5 takes place automatically through the action of the spring 7 without the need for any manual intervention by the user.

As shown in Figure 7, said telescopic movement of the sleeve 5 and of the syringe 100 is controlled and regulated by the user's hand. In fact the user keeps the index and middle finger on the flanges 53 of the sleeve and the thumb on the rear flange 42 of the plunger shaft, accompanying the stroke of the sleeve 5 and of the syringe 100 towards the position of safety and thus regulating the speed of relative movement of the sleeve 5 with respect to the syringe 1 as desired by the user.

At the end of the stroke of the sleeve 5, as shown in Figures 6 and 8, the body 80 of the abutment member 8 is retained between the two pairs of tongues 56 and 66. That is to say, the rear abutment surface 58 of the front tongues 56 abuts against the shoulder 84 of the abutment member, preventing forward movement thereof, whilst the front abutment surface 68 of the rear tongues 66 abuts against the rear edge of the body 80 of the abutment member, preventing rearward movement thereof. Detachment of the abutment member 8 from the syringe body can be caused by exerting a strong forward traction on the sleeve, but the needle 2 nevertheless remains trapped, together with the abutment member, in the sleeve 5.

It should be noted that in the present invention, the spring 7 remains protected inside the sleeve 5, even when the sleeve 5 is in its forward safety position.

It should further be noted that in the present invention, a syringe of a conventional type, composed of the body 1, the plunger 4 with the shaft 41 thereof and the needle 2

with the support 20 thereof, is made into a safety syringe by the use of only three additional elements forming part of the guard mechanism 200, that is to say, the sleeve 5, the spring 7 and the abutment member 8. Furthermore, the set of components 200 can optionally also comprise the operating crown 43 to be applied to the shaft 41 of the piston, in the event of said operating crown 43 not being made integral or in a single body with the shaft 41.

Numerous variations or modifications of detail within the reach of a person skilled in the art can be made to the present embodiment of the invention, without thereby departing from the scope of the invention as set forth in the appended claims.